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REVIEW

# Cervical cerclage: A review

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**Abstract** Cervical cerclage is a common prophylactic intervention that has been used in the management of second trimester loss for several decades, yet it remains one of the more controversial surgical interventions in obstetrics. The diagnosis of cervical insufficiency is notoriously difficult to make, and is usually a retrospective one based on a history of recurrent second trimester loss (or early preterm delivery) following painless cervical dilatation in the absence of contractions, bleeding, or other causes of recurrent pregnancy loss. This article reviews the current literature regarding the efficacy of transvaginal cerclage (in both an elective and emergency setting), therapeutic cerclage (whereby a suture is inserted on the basis of ultrasound evidence of cervical shortening) and transabdominal cerclage.
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## Introduction

Preterm birth (defined as the birth of an infant prior to 37 completed weeks gestation[1]) is the single most important determinant of neonatal morbidity and mortality. Approximately 13 million preterm births occur annually worldwide with an incidence ranging from approximately 5 to 12%.[2] In developed countries the incidence is increasing due to progress in assisted reproductive techniques leading to more multifetal pregnancies. Improved antenatal surveillance and identification of at-risk pregnancies as well as earlier intervention may also have contributed to an increase in iatrogenic premature deliveries. Yet, despite advances in perinatal medicine, the major adverse long-term outcomes of preterm birth such as bronchopulmonary dysplasia, intraventricular haemorrhage, necrotizing enterocolitis and cerebral palsy have not lessened and remain a public health issue.

The exact aetiology of preterm birth is unknown, and is probably multifactorial in nature. Factors such as maternal infection, multiple gestation, and placental insufficiency for example can all lead to preterm birth. Therapeutic intervention to treat established preterm labour (secondary prevention)

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with tocolytic agents has been disappointing, despite many pharmacological compounds being investigated as potential tocolytic agents. Hence much research has focused on prediction and primary prevention.[3] Whatever the cause of onset of parturition, the final common pathway in the cascade of events leading to preterm birth is cervical shortening and dilatation, hence cervical cerclage as a primary prevention technique.

The role of the cervix is to provide mechanical strength and act as a barrier to prevent ascending infection. In some cases cervical dysfunction may be the primary problem, but true cervical insufficiency is probably rare. Unfortunately there is no diagnostic test for cervical insufficiency and the diagnosis is usually a retrospective one based on a history of recurrent second trimester loss (or early preterm delivery) following painless cervical dilatation in the absence of contractions, bleeding, or other causes of recurrent pregnancy loss.[4]

## Cervical cerclage: surgical technique

Cervical cerclage was first proposed by Shirodkar in 1955.[5] A circular incision is made around the cervix at the level of the internal os. The bladder is carefully dissected away (often a dilute solution of adrenaline is infiltrated in order to open tissue planes and promote haemostasis). Similarly an incision is then made in the posterior fornix and opened. An encircling suture (usually mersilene tape or nylon) is placed in the region of internal os and lower uterine segment, by passing anteroposteriorly then postero-anteriorly through the paracervical broad ligament. The knot is then tied in front of the cervix in the midline, and the incisions closed with continuous 2/0 Vicryl. Sometimes a modified Shirodkar technique can be used with the knot tied posteriorly and buried. This technique was considerably simplified by McDonald in 1957 and does not require the bladder to be dissected free.[6] A purse-string suture is placed as high as possible around the cervix to approximate to the level of the internal os.

There have been no randomised controlled trials comparing Shirodkar cerclage with McDonalds cerclage, although some assume that the 'higher' the suture is placed the better, as this provides a longer functional cervix.[7] Comparing the two sutures by ultrasound cervical measurement does reveal a greater increase in cervical length associated with the Shirodkar suture. However a few retrospective studies find no statistical difference in the rate of preterm birth or neonatal survival between the two methods.[8–10]

## Elective cerclage

Despite cerclage being available for over half a century, only three randomised controlled trials have been conducted comparing cerclage with expectant management.[11–13] Lazar recruited women considered to be at moderate risk of cervical incompetence based on a scoring system to assess risk factors.[11] A total of 506 women were randomised with 268 allocated to a McDonalds cerclage, and 238 to a policy of no cerclage. Despite the groups being comparable for past previous preterm deliveries, those in the cerclage group had had significantly more second trimester losses. Regarding outcomes, there was no significant difference in preterm delivery between the two groups, although those with cerclage were more likely to be admitted to hospital and receive tocolytics. Rush recruited 194 women who had had at least two previous preterm deliveries prior to 37 weeks (or one or more prior to 34 weeks); 96 patients were randomised to McDonalds cerclage and 98 to expectant management.[12] There was no difference in outcome, with 34% delivering prior to 37 weeks in both groups. The largest trial coordinated by the Medical Research Council and Royal College of Obstetricians and Gynaecologists was an international multicentre trial which recruited 1292 women whose obstetrician was uncertain as to whether a cerclage would be of benefit.[13] Randomisation allocated 647 women to cerclage and 645 to no cerclage. Overall there were fewer deliveries prior to 33 weeks in the cerclage group compared with the controls (83/647 versus 110/645 $p = 0.03$). However the reduced incidence of preterm delivery did not result in obvious benefit for the neonates and the number needed to treat to prevent one incidence of preterm birth is about 25. The trial has been criticised for only recruiting those with an uncertain diagnosis of cervical insufficiency and hence diluting the results by excluding those at highest risk. However the overall preterm delivery rate was 28%, which one would expect in a high risk population. In the subgroup of women with three or more second trimester losses the insertion of a cervical suture halved the incidence of preterm delivery prior to 33 weeks.

Cervical cerclage is not without risk. Reported adverse events shortly after suture insertion include abdominal pain, vaginal bleeding, premature prelabour rupture of the membranes (pPROM) and bladder injury. Late complications can include

chorioamnionitis; one systematic review found a two and a half fold increased risk in maternal infection.[14] The use of tocolytics was also significantly associated with cerclage. Other subsequent complications can also include preterm delivery, uterine rupture,[15] and pPROM.[12] The incidence of difficulty in cerclage removal is reported as 1%.[13]

## Emergency cerclage

As cervical shortening and dilatation usually occurs without symptoms it may be that on presentation the fetal membranes are already visible, protruding through the external os in an 'hour glass' shape and an emergency or 'rescue' cerclage is performed once other causes of second trimester miscarriage have been excluded. The patient is placed in the Trendelenburg position and the herniating forewaters are gently reduced with the aid of an inflated Foley catheter.[16] Some have tried amnioreduction to aid successful cerclage, although this was not found to prolong the pregnancy.[17]

There has been no randomised study evaluating the use of emergency cerclage. One non-randomised prospective study comparing emergency cerclage with bed rest found those treated with cerclage had a significantly higher mean birth weight, but this did not translate into a difference in perinatal mortality, and the study was small.[18] Factors associated with delivery prior to 28 weeks in those women treated with emergency cerclage are reported to include membranes prolapsing beyond the level of the external os, need for cerclage prior to 22 weeks gestation and nulliparity.[19] Subclinical infection of the fetal membranes or intrauterine space is implicated in up to 40% of cases of very preterm birth[20] and some studies have performed amniocentesis prior to cerclage to exclude this and try to identify proteomic biomarkers that could predict outcome.[21]

## Transabdominal suture

In those with a very poor past obstetric history, when conventional cerclage by the vaginal route has not been successful or when extensive cervical surgery has left very little cervical tissue vaginally, a transabdominal procedure can be attempted. Transabdominal cervical cerclage (TAC) was first described in 1965[22] and involves a laparotomy to insert a suture above the cardinal and uterosacral ligaments (although the procedure has also been reported laparoscopically).[23] Theoretically the higher placement of the suture may be better at preventing any funnelling at the internal os[24] and hence reduce the risk of pPROM. Most case series of TAC have reported excellent success rates (85–90%).[25] A systematic review comparing TAC with transvaginal cerclage in patients with a previous failed transvaginal cerclage found the likelihood of perinatal death or delivery prior to 24 weeks was 6% after TAC, compared with 12.5% after repeat transvaginal cerclage.[26] With a TAC, most often two laparotomies are required (one for insertion and one for caesarean section) and the likelihood of other complications needs to be considered such as bleeding, pregnancy loss and intrauterine growth restriction from inadvertent ligation of the uterine arteries.[25]

## Ultrasound-indicated suture

Despite cervical cerclage being used in the management of suspected cervical insufficiency for nearly half a century there is still a wide variation in the use of cerclage, which reflects the lack of evidence on the efficacy of the procedure. A diagnosis of true cervical insufficiency is notoriously difficult to make, as preterm labour is most probably multifactorial in nature. Traditionally the decision to perform cervical cerclage has been based on a past obstetric history of a previous preterm delivery/second trimester loss, however it is likely that many sutures are inserted unnecessarily. Therefore in order to identify those whom may benefit from a cerclage, transvaginal ultrasound of cervical length is used as predictor of preterm delivery.

Transvaginal measurement of cervical length is highly reproducible, with little inter- and intra-observer error (3.5 mm or less, and 4.2 mm or less respectively).[27] A transvaginal probe is placed in the anterior fornix and a sagittal section of the cervix is obtained, with the internal os, endocervical canal and external os in view. The bladder should be empty to avoid pressure falsely elongating the cervix and three measurements taken over a period of 3–5 min.

Measurement of cervical length has been demonstrated to be a sensitive predictor of preterm delivery in both low risk[28,29] and high risk pregnancies.[30,31] For early preterm delivery a cervical length of less than or equal to 15 mm has a positive predictive value of approximately 50%, and a negative predictive value of over 95%.[32] The risk of preterm delivery increases exponentially with decreasing cervical length, from less than 1% at 30 mm to 80% at 5 mm.[29]

Cervical ultrasound is now being used by some as a screening test to identify those women who are at risk, with a therapeutic/ultrasound-indicated cerclage inserted based on the findings of a short cervix. However the evidence regarding whether this reduces the risk of preterm delivery is conflicting. There have been four randomised controlled trials comparing ultrasound indicated cerclage with conservative management.[33–36] Rust et al. randomised 113 patients with a short cervical length (<25 mm) to receive either a cerclage ($n = 55$) or expectant management ($n = 58$). There was no significant difference in preterm delivery between the cerclage and no-cerclage group (35% versus 36%).[33] Berghella et al. also randomly assigned 61 women found to have a short cervix (<25 mm) to cerclage ($n = 31$) and no cerclage ($n = 30$). Their primary outcome was preterm delivery prior to 35 weeks gestation. Again no difference in outcome was found in those who received a cerclage (14/31) compared with those who did not (14/30).[34] To et al. randomised 253 with a cervical length of 15 mm or less to cerclage ($n = 127$) or expectant management ($n = 126$). The proportion of preterm delivery prior to 33 weeks was similar in both groups, 28/127 in the cerclage group versus 33/126 in the control group ($p = 0.44$).[35] The fourth randomised trial, the CIPRACT trial by Althusius and co-workers, recruited only women who were at high risk for spontaneous preterm delivery having had a past obstetric history suggestive of cervical insufficiency.[36] As part of a larger study on cerclage, 35 women were found to have a cervix less than 25 mm as detected by ultrasound. Of the 19 women who received a cerclage, none delivered before 34 weeks, which was statistically significantly less than the 7/16 women who were on bed rest alone.

There are several problematic aspects of the study designs, which make interpretation of these trials difficult. Berghella, Rust and To selected both high risk and low risk women. Rust delayed cervical cerclage for 48–72 h whilst amniocentesis culture excluded infection. Berghella and Rust included twin pregnancies, however the pathophysiology of preterm labour in multifetal pregnancies and the cervical length at which to intervene may be different from singleton pregnancies. Also Rust and Berghella included women who had cervical funnelling, irrespective of cervical length (an ultrasonographical finding whereby there is dilatation of the internal os with prolapse of the fetal membranes into the endocervical canal). It has been suggested that the presence of a funnel is associated with an increased risk of preterm delivery,[37] although this may only hold true for those with a short cervical length.[38] The appropriate threshold for therapeutic cerclage is unknown. To et al. acted on a cervical length of 15 mm as the risk of delivery increases exponentially at lengths less than this. However this may be too late to intervene as a preoperative length of less than 15 mm is associated with visible fetal membranes at the time of suture insertion, and a poor outcome.[39]

However, in singleton pregnancies of women who have had a previous preterm birth or second trimester loss, cerclage appears to be associated with a significant reduction in preterm birth[36] and a meta-analysis of this subgroup of patients from the above trials agrees with this conclusion despite the numbers being small.[40] Further large randomised controlled trials on women at high risk of preterm birth are needed.

## Conclusions

Despite cervical cerclage being a relatively common operative procedure, there is still little evidence as to its efficacy, and with it being a widely accepted practice it is unlikely that further trials comparing cerclage with no cerclage in women at high risk of preterm delivery will be performed. Those women with the highest risk of preterm delivery are the most likely to have the highest probability of deriving benefit, and with relatively few complications it would seem prudent to offer cervical cerclage to them. However in those with a less certain diagnosis the decision is less clear. In trying to identify those women who will deliver preterm, ultrasound is a useful screening tool. The evidence is still conflicting as to whether cerclage is beneficial once cervical shortening is seen and at what cervical length to intervene. However, in singleton pregnancies deemed high risk from past obstetric history, offering cerclage to a patient with a short cervix, may reduce preterm birth but further large randomised controlled trials are needed to evaluate this.

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